

*Firmado y
entregado a Gemini
10. Enero 2000*

**Gemini Science Archive Conceptual Design Study
Work Scope No. 9414257-GEM02012**

This Work Scope is entered into on 15 December 1999 by and between the Association of Universities for Research in Astronomy, Inc. ("AURA"), the National Research Council of Canada ("NRC"), and Comisión Nacional de Investigación Científica y Tecnológica ("CONICYT"). NRC and CONICYT are collectively referred to as "the Partners."

1. General. (a) With respect to NRC, the rights and obligations under this Work Scope are subject to the provisions of the Working Agreement between AURA and NRC in all respects. With respect to CONICYT, the rights and obligations under this Work Scope are subject to the provisions of the Working Agreement between AURA and CONICYT in all respects.

(b) The Working Agreements will hereinafter be referred to as the "Agreements".

(c) A portion of the Work described in this Work Scope may have been performed by the Partners prior to the date of this Work Scope. All such Work will be governed by this Work Scope to the same extent as if performed after the date of this Work Scope.

(d) AURA will decide whether or not to enter into later work scopes with the Partners for the actual development of the Science Archive based upon the Phase II proposal submitted by the Partners as described in Section 8.6, below.

(e) In the event that one of the Partners is unable to perform its portion of the Work, or fails to adequately perform its portion of the Work, the other Partner shall be responsible for successfully completing all of the Work for a total cost to AURA, including any payments previously made to the defaulting partner, equal to the total fixed price given in section 5 below. In no event shall AURA be required to pay any amounts in excess of this fixed price because one Partner had to do, or redo, work that the other Partner was supposed to perform.

(f) The Partners shall be responsible for coordinating the allocation of the Work between themselves so that AURA shall not have any role in determining which parts of the Work are performed by which Partner.

(g) The Partners shall be responsible for all aspects of the management of the Work, so that AURA is not responsible for any coordination of effort between the Partners. All disputes between the Partners with regard to the Work shall be resolved by the Partners without any involvement by AURA.

(h) The effort of both Partners shall be managed by the NRC Work Package Manager so that the Work is performed under a single management structure.

(i) All reports and documentation required under this Work Scope will be delivered as single documents issued by both Partners. In no event shall the Partners deliver separate documentation or reports.

2. Definitions.

Science Archive. This term is defined in section 7, below.

Requirements. This term is defined in section 7, below.

Schedule. The term "Schedule" refers to the provisions of section 6, below.

3. Scope of Work. (a) The Partners will perform all tasks necessary to successfully develop a conceptual design and a functional prototype for a Science Archive which will meet the Requirements, and will perform other tasks related to the Science Archive, all as set forth in more detail below (the "Work").

(b) In performing the Work, the Partners will work closely with the Gemini Software Contact to ensure that the design of the Science Archive will be well integrated into the Gemini software and networking environment.

(c) The Partners will use the hardware and software already provided to NRC for the Cerro Pachon Data Handling System to perform this Work. This hardware will be returned to AURA at the end of this Work Scope if requested by AURA.

4. Contacts. (a) The primary contacts under this Work Scope are as follows:

AURA: Fred Gillett, Gemini Project Scientist
Partners: Séverin Gaudet, Work Package Manager

(b) The Partners have designated Daniel Durand as the Work Package Scientist and Luis Campusano as Associate Work Package Scientist.

(c) AURA has designated Kim Gillies as the Gemini Software Contact and Ted von Hippel as Archive Support Scientist.

(d) The Work Package Manager and Work Package Scientist are designated as key personnel, and cannot be changed without the consent of AURA.

(e) The Work Package Manager shall represent both NRC and CONICYT with respect to this Work Scope, and shall have the authority to making binding decisions and commitments for both Partners.

5. Payment. (a) The partners will perform all of the Work for a total fixed price of USD 191,300. Each Partner is entitled to receive the following fixed payment for successful completion of its portion of the Work, unless otherwise provided in this Work Scope:

CONICYT: USD 74,750
NRC: USD 116,550

(b) AURA will make progress payments to the Partners as follows:

- (1) One third of each Partner's share upon approval by AURA of the Management Plan.
- (2) One third of each Partner's share upon approval of the Initial ICD by AURA.
- (3) The balance upon completion of all of the Work.

(c) To receive payment as specified in paragraph (b) above, each Partner must deliver an invoice to AURA for each payment requested. This invoice will give the number of this Work Scope and state that the relevant milestone has been reached. AURA will pay each such invoice within 30 days of either the date it is received or the date that the Partners successfully complete the appropriate milestone, whichever is later.

6. Schedule. The Partners will commence performing the Work promptly upon receiving a fully executed original of this Work Scope, and will complete the following tasks by the dates given below:

| Event | Date |
|--|-----------|
| (1) Submit Management Plan to AURA | 08-Feb-00 |
| (2) Submit draft Initial OCDD to AURA | 10-Mar-00 |
| (3) Submit Initial OCDD to AURA | 14-Apr-00 |
| (4) Submit draft Initial FPRD to AURA | 14-Apr-00 |
| (5) Submit Initial FPRD to AURA | 12-May-00 |
| (6) Submit Initial ICD to AURA | 09-Jun-00 |
| (7) Submit Conceptual Design Documentation Outline to AURA | 24-Nov-00 |
| (8) Submit Conceptual Design Documentation to AURA | 12-Jan-01 |
| (9) Make Prototype available to AURA | 12-Jan-01 |
| (10) Submit Phase II Proposal to AURA | 12-Jan-01 |
| (11) Conceptual Design Review | 26-Jan-01 |

7. Requirements.

7.1. General. The science archive for the Gemini Telescopes will generally consist of a copy of all of the scientific and ancillary data obtained by Gemini, together with a catalog of the data, all of which will be located at one or more physically secure sites which will be accessible by the Gemini user community through a high-speed Internet link. This Work Scope does not cover operation of the Gemini archive.

7.2 Requirements for Science Archive. (a) The Partners will develop a conceptual design for the Science Archive that incorporates all of the requirements given in section 7.2.1, below (the "Requirements"). The Partners shall ensure that using their conceptual design, the Phase II development cost, including both hardware and software, will be less than USD 150,000.00 and the annual operating cost will be less than USD 175,000.00. The Partners shall immediately inform AURA, in writing, if at any time during the Work they believe that it is unlikely that one

or both of these budget requirements can be met, and AURA will then decide, working in consultation with the Partners, whether to increase the budget, decrease the requirements, or terminate the work.

(b) "A" and "G" indicate whether the function is primarily the responsibility of the Archive or of Gemini, respectively. In all cases the other party will be actively involved as well.

7.2.1. Requirements

(a) Provide secure data storage of all archived data received by the archive center for the duration of the Science archive (A).

(b) Provide capability to control and limit access to scientific data in the archive, e.g. ensure proprietary periods are respected and data access enabled after expiration of proprietary period (A).

(c) Provide access to all descriptors necessary to understand the data, including basic information and the science abstract from the original science program (G).

(d) Provide electronic logging to facilitate calibration (G).

(e) Provide atmospheric monitoring data (G).

(f) Ensure that a minimum level of calibration material is always obtained and archived (G).

(g) Archive all raw data from both queue and classical observations from facility-class instruments (A).

(h) Provide software and hardware to allow easy browsing and retrieval of data (A).

(i) Provide quick-look reduction pipelines for each archived instrument mode (G).

(j) Provide data quality assessment for each archived science data set (G).

(k) Provide for on-line storage of science data, including a catalogue of the science data sets, relevant calibration frames, and pipeline processing (A).

(l) Provide an on-line science catalogue of the archive data that allows for mirror capabilities in the partner countries. The catalogue information should be in scientific units and include all stored environmental information relevant to the science data set (A).

(m) Provide science catalogue search capabilities including previews of the data set with compressed visualization (A).

(n) Provide retrieval and delivery systems, including both network and physical delivery (A).

7.2.2. Advanced Capabilities. The Partners shall prepare separate development and operational cost estimates for each of these capabilities to the extent possible given the budget for this Work Scope.

(a) Provide advanced search capabilities (A).

(b) Provide for on-the-fly recalibration of the science data sets using the best calibration files available (A).

(c) Provide cross-referencing to other archives, including cross-archive queries and multi-archive queries (A).

(g) Provide visualization and plotting tools (A).

(h) Provide data mining capabilities (A).

8. Specific Tasks and Deliverables.

8.1. Management Plan. The Partners shall prepare and submit to AURA a "Management Plan" which consists of the following:

(1) A Work Breakdown Structure (WBS) prepared in Microsoft Project or equivalent software detailing all of the tasks necessary to complete the Work, with sub-tasks described down to the third level. Each WBS element should have a duration, cost, manpower required, and resources required. Each WBS element should also have a brief description of how duration, cost, manpower, and resources were calculated or estimated, together with an assessment of the margin of error in the amounts given. This information can be in a separate document keyed to the task numbers.

(2) A schedule based upon the WBS, showing when each task will be completed.

(3) A list describing the manpower, equipment, space, and other resources that will be needed to complete the work. This list must be based upon the WBS, and must include the estimated cost with a margin of error, the source of cost information, dates required, and any additional information about the resources availability.

8.2. Initial Operational Concept Definition Document. (a) The Partners will develop the operational concept model for the Science Archive based on the Requirements and discussions with AURA, and will prepare an Initial Operational Concept Definition Document (Initial OCDD) which presents the science cases for which the Science Archive will be designed, relate these to the Requirements, and discuss the key functional and performance requirements that the

Science Archive must meet.

(b) The Initial OCDD will also identify and discuss the key operational scenarios of the Science Archive, especially in terms of the requirements this facility will place on other parts of the Gemini system. These scenarios should be described in sufficient detail for a technically and scientifically skilled, but non-expert, audience to understand.

(c) A draft Initial OCDD will be prepared by the Partners and submitted to AURA for review and comment by the date specified in the Schedule. This draft Initial OCDD will have a complete table of contents, a first draft of all sections, and some sections in nearly final form to indicate the organization and level of detail of the document, but will not necessarily be complete. The Partners will promptly incorporate into the Initial OCDD all changes requested by AURA that would be necessary to make it consistent with the Requirements.

(d) The Partners will deliver the completed Initial OCDD to AURA by the date specified in the Schedule, and AURA shall promptly review it. The Partners will incorporate into the Initial OCDD all changes requested by AURA which are reasonably necessary to make it consistent with the Requirements, and will submit the revised Initial OCDD to AURA for approval.

8.3. Initial Functional and Performance Requirements Document. (a) The Partners will develop the functional and performance requirements that the Science Archive will have to meet in order for it to meet the requirements of the Initial OCDD and the Requirements, and will prepare an Initial Functional and Performance Requirements Document (Initial FPRD).

(b) The Partners will describe the origin of each functional and performance requirement described in the Initial FPRD, so that users of the Initial FPRD will be able to determine why each functional and performance requirement was included in the Initial FPRD.

(c) The Initial FPRD must clearly state the Partners' assumptions regarding the characteristics or performance capabilities of the other parts of the Gemini system including, but not limited to, the engineering archive. For each of these, the Initial FPRD must state whether the current performance of these systems support the Science Archive requirements set forth in the Initial FPRD.

(d) A draft Initial FPRD will be prepared by the Partners and submitted to AURA for review and comment by the date specified in the Schedule. The draft Initial FPRD will have a complete table of contents, a first draft of all sections, and some sections in nearly final form to indicate the organization and level of detail of the document, but will not necessarily be a complete detailing of the requirements. The Partners will incorporate into the Initial FPRD all changes requested by AURA that would be reasonably necessary to make it consistent with the Requirements.

(e) The Partners will deliver the complete Initial FPRD to AURA by the date specified in the Schedule, and AURA shall promptly review it. The Partners will incorporate into the Initial

FPRD all changes reasonably requested by AURA which are reasonably necessary to make it consistent with the Requirements, and will submit the revised Initial FPRD to AURA for approval.

8.4. Initial Interface Control Document. The Partners will determine which existing and/or future Gemini facilities, structures, and systems will interface with the Science Archive and will prepare a document (the "Initial ICD") that lists all of these interfaces and describes the essential requirements of each interface to the degree necessary to successfully develop the conceptual design of the Science Archive. The Partners will work closely with the Gemini Software Contact in developing the Initial ICD to ensure that the Science Archive interface requirements match Gemini's current and future data infrastructure. The Partners will be responsible for requesting information from AURA and/or other sources regarding the designs of Gemini facilities, structures, and systems, and AURA will provide such information to the Partners. AURA will promptly inform the Partners of any information regarding Gemini which might be relevant to the Work.

8.5. Functional Prototype. (a) The Partners will develop a hardware and software prototype of the Science Archive (the "Functional Prototype"), incorporating sufficient functionality to demonstrate how each of the Requirements will be met. This prototype will be made available to AURA for inspection by the date indicated in Section 6, and will also be demonstrated during the Conceptual Design Review.

8.6. Conceptual Design. (a) The Partners will prepare a conceptual design for the Science Archive which will meet all of the Requirements, and will perform all analysis reasonably required to demonstrate that this design will meet all of the Requirements. This conceptual design will be set forth in a set of documentation (the "Conceptual Design Documentation") which will include, but not be limited to, the following:

- (1) An Initial OCDD that has been previously approved by AURA.
- (2) An Initial FPRD that has been previously approved by AURA.
- (3) A comparison of the Requirements with the Initial FPRD and Initial OCDD.
- (4) An Initial ICD that has previously been approved by AURA.
- (5) A conceptual design for the Science Archive, including but not limited to a description of the design and capabilities of the Functional Prototype.
- (6) Preliminary analyses that verify that the conceptual design and Functional Prototype meet the requirements of the FPRD.
- (7) A description of any issues or performance trade-offs involved in the conceptual design.

(b) The Partners will prepare an outline of the Conceptual Design Documentation and deliver the same to AURA for review by the date given in the Schedule. This outline will contain enough information to allow AURA to evaluate the general design approach, the proposed individual documents and drawings to be included of the Conceptual Design Documentation, and the general format of the documents and drawings. Within two weeks after receiving this outline, AURA will provide the Partners with comments and suggestions regarding the form and contents of the Conceptual Design Documentation.

(c) The Partners will deliver the Conceptual Design Documentation to AURA for review by the date given in the Schedule.

8.7. Phase II Proposal. (a) After the conceptual design has been prepared, the Partners will prepare documentation describing its proposal for performing the detailed design, coding, and testing, of a Science Archive which meets all of the Requirements (the "Phase II Proposal"). This proposal will represent the Partners' commitment to perform the work described in the Phase II Proposal in conformance with its proposed price, schedule, and scope of work. The Phase II Proposal will contain, at a minimum, the following information:

(1) A work breakdown structure listing all of the tasks necessary to complete the Phase II work, and giving the estimated start dates and finish dates for each task. The Partners will consult with AURA regularly in developing the tasks included in Phase II to ensure that AURA and the Partners are in agreement regarding the scope of work for Phase II.

(2) A budget for performing the Phase II work described in sufficient detail to allow a meaningful analysis of the completeness of the budget.

(3) A proposed fixed price for performing the Phase II work.

(4) A description of the documents that have been used to define the Requirements for the Phase II work.

(5) A narrative description of any issues and/or potential problems foreseen in the Phase II work, including, but not limited to, any changes to the Requirements that are thought to be required.

(6) A firm proposal for operating the Science Archive once it is completed. This proposal should include the staffing structure for operations, the scope of service that would be provided by the Partners, a proposed fixed annual cost to AURA, and how many years the Partners are willing to commit to at that fixed annual cost. The operating cost proposal may include annual inflation adjustments which are tied to an inflation index published by the Canadian government.

(7) A proposal to add the Advanced Capabilities (Section 7.2.2) to the Science Archive. This proposal shall give a separate development price and annual operational cost for each Advanced Capability, so that AURA is able to select some, all, or none of the Advanced

Capabilities for inclusion in Phase II.

(b) The Partners will deliver the Phase II Proposal to AURA for review by the date given in the Schedule.

8.8. Conceptual Design Review. (a) The Partners will present the conceptual design of the Science Archive, and the Functional Prototype to the review committee at the Conceptual Design Review, as provided in more detail below.

(b) AURA and the Partners will call and conduct the Conceptual Design Review. AURA will select a review committee chair and will select the review committee members with the concurrence of the review committee chair.

(c) Five copies of the Conceptual Design Documentation will be delivered to AURA, and one copy each will be delivered to the review committee members, at least two weeks before the date of the Conceptual Design Review.

(d) Within ten working days after receipt of the review committee report, AURA will produce a written report, based on the verbal and/or written input from the review committee, containing a list of proposed actions (the Review Actions).

(e) Within ten working days of receipt of the Review Actions, the Partners will produce a response to this report (the Review Response) that includes what actions the Partners intend to take for each issue raised in the Review Actions, when the actions will be completed, and the Partners' position as to which of the proposed actions are within the scope of the Work. For actions that are considered by the Partners to be outside the scope of the Work, the Partners will provide a cost to AURA of including the action with the Work.

(f) Within ten days of receipt of the Review Response (including the cost of work believed to be out of scope by the Partners) by AURA, AURA may direct that changes be made to the Conceptual Design Documentation that are required to make it consistent with the Requirements. The Partners will promptly comply with all such direction, and will complete the changes within a reasonable period of time (nominally 30 days).

9. General.

9.1. Progress Reports. The Partners will submit written progress reports to AURA describing the technical, schedule, and financial progress of the Work. These will include:

(a) On a monthly basis: minutes of the progress meetings for the previous month, and any applicable technical reports produced during the previous month.

(b) Every three months, starting one month after the signing of this Work Scope:

(1) information regarding the technical status of the Work;

(2) an updated Management Plan to consist of the most current project plan to completion. This plan will be maintained in Microsoft Project, or equivalent;

(3) a list of the major milestones with the original, previous, and current date by which they will be attained - any significant changes from the previous date will be explained, and each subsequent list will include all the explanations from previous lists;

(4) problem areas related to the Work, including potential for delays;

(5) action items for AURA and the Partners (both open and closed), and associated status;

(6) proposed changes in key personnel.

9.2. Meetings. The fixed price for the Work includes the costs of attending agreed meetings. AURA may request that the Partners present information related to the Work before additional review committees from time to time. AURA will provide at least thirty days notice of these reviews to allow for preparation of materials. AURA will use its best efforts to phase the information required for additional reviews with the Work. Unless AURA pays the additional direct costs of attendance at additional reviews, the Partners are not bound to attend.

9.3. Access by AURA. The Partners will grant AURA personnel access at reasonable times to all places where the Work is being performed, including access to locations where the Partners' subcontractors are performing any part of the Work.

9.4. Disputes. Disputes between AURA and the Partners will be resolved as provided in Section 14 of the Agreements.

9.5. Sub-contractors. The Partners may utilize sub-contractors in performing the Work, as provided in the Agreement.

9.6. Information Transfer. AURA and the Partners will respond to requests for information related to this Work Scope in a timely fashion. All such requests for information will specify a date by which said information is required. Each party will use its best efforts to provide the requested information by the date requested. The transfer of information will be via the primary contacts for this Work Scope.

Acknowledged and agreed:

AURA


Gemini Project Scientist

Gemini Project Manager

NRC

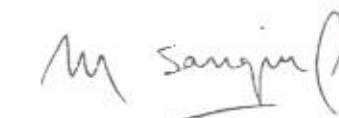


Work Package Manager



Director General, Herzberg Institute
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CONICYT



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